

## COMMUNICATION THROUGH HEARING AIDS\*

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WE do not hesitate to wear eyeglasses for minor visual problems; yet, before we turn to a hearing aid we wait until our families and associates can no longer communicate with us. Unfortunately, we cannot expect to hear as well when we put on a hearing aid as we can see when we put on glasses. This fact comes as a great disappointment to thousands of persons who have impaired hearing. Loss of hearing, although our most common disability, is not well understood by the public. Neither is the function of a hearing aid.

No other rehabilitative tool has so inflamed the emotions of consumers, clinicians, salesmen, and manufacturers as the hearing aid. Misinformation and lack of information have contributed to this situation. It is the purpose of this paper to discuss the available types of hearing aids and to provide information about their use.

The audiologist faces many decisions in selecting the mode of amplification most appropriate for his patient. He has to consider where the aid shall be located—whether on the body, behind the ear, in the ear, or in eyeglasses. He has to consider whether the aid shall be of the usual type with microphone, amplifier, and earphone all in the same unit or whether it should have a microphone on the side opposite the receiver (contralateral routing of signal—CROS), or two microphones—one on each side of the head—and one receiver (bilateral routing of signal—BICROS). The audiologist must select an appropriate earmold—closed, open, or variably vented. He must determine whether other characteristics are desired, such as directionality or compression. He must make decisions regarding frequency response, gain, and saturation sound-pressure level. He must

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decide whether to recommend one aid (monaural fitting) or two aids (binaural fitting).

In the selection of the hearing aid, the purpose is to recommend an aid that will assist the patient in improving his communicative skills. The degree to which the wearer attains success with the hearing aid depends in large measure on his adjustment to aided hearing. It also depends on the many factors to be considered before the aid is finally selected. Let us discuss these factors.

#### WHERE TO WEAR THE AID

Years ago only one kind of aid was available, the one worn on the body. With the decreasing size of power supply, microphone, receiver, and amplifier, aids could be placed in eyeglasses, in units worn behind the ear, and even entirely within the ear. It is so convenient to wear the hearing aid at the level of the head that body aids usually are worn only when a great deal of power is required. There are two exceptions to this generalization. The first considers the elderly, who may have failing eyesight and restricted use of the fingers. With the body aid, the large dials, controls, battery, and battery compartment cover make use by the elderly relatively easy. The second exception applies to children. An extended frequency response essential for the acquisition of speech can be obtained with body aids and cannot yet be obtained with other types of equipment.

Eyeglass aids are losing popularity. The relatively high incidence of breakdown in eyeglass aids is a factor to be considered. Because of the combined weight of the hearing aid and lenses, proper fit can be critical. Many patients object to relinquishing aided hearing whenever they remove their glasses. In certain ocular conditions, where distance and angle between pupil and lens must remain constant, hearing-aid eyeglasses must be avoided. Often eyeglass aids are recommended only at the request of the patient or when a CROS or BICROS aid is indicated, since CROS and BICROS aids are more frequently available in eyeglasses.

The retroauricular or behind-the-ear aid is the most common type and can accommodate special features. The increasing gain and saturation sound-pressure levels of these aids have been instrumental in reducing the use of body-worn aids. The size and shape of retroauricular aids are such that they usually can be worn in conjunction with eyeglasses.

When aids worn within the ear first made their appearance, it was

thought that such small instruments would never provide enough gain for more than the mildest hearing losses. However, with advances in technology, there is now sufficient gain for moderately severe losses. At the moment the limitation in gain is created by the close proximity of the microphone to the receiver.

#### AIDS WITH SPECIAL CHARACTERISTICS

CROS and BICROS aids have brought many benefits. To make use of a microphone on the side of the head opposite the ear that holds the receiver, a CROS aid may be placed in eyeglasses, in two retroauricular aids connected by a cord, or in two aids placed in the ears and connected by a cord. The CROS aid is intended primarily for two classes of patients: those who have no useable hearing on one side or those who have a high-frequency loss on one side. In both instances the receiver is utilized with an open mold or a simple piece of bent plastic tubing. Depending upon the desired result, this tubing may be long enough to extend part-way into the external auditory canal or short enough to focus sound toward the concha. The BICROS aid with a microphone on each side terminating in an amplifier and receiver in one ear is indicated for patients who have no useable hearing in one ear and a significant loss in the other. A closed or vented mold would be indicated in most instances.

A recent development is the hearing aid with high frequency emphasis, sometimes called the high-pass hearing aid. These aids usually offer no amplification below 1,000 Hz and some provide amplification only above 2,000 Hz. The high-pass hearing aid has been used successfully by persons who have good hearing in the low frequencies but a rapidly descending audiometric curve in the higher frequencies. Individuals with this type of loss can hear conversation but have difficulty in understanding it, especially in the presence of noise. High-pass aids are usually worn with an open earmold or a vented earmold. For many years persons with high-frequency loss have been told that no hearing aid in existence is applicable to this problem. This certainly is no longer true. In fact, it is not at all uncommon for a high-pass hearing aid to produce significant improvement in the ability to understand speech at conversational levels of loudness.

The compression-type hearing aid has been available for years. Its purpose is to keep a loud signal from being amplified to an uncomfortable level. The response of a compression system is not instantaneous; time is

required for it to operate. This period is known as the attack time. It is the time elapsed between the moment the signal input exceeds the limiting level and the moment when the gain becomes stabilized at a reduced level. When the input level decreases, it takes a moment for the compression system to release and restore the normal gain. This lag is called release time. Compression aids can have very short attack times, less than 5 milliseconds; recovery times average between 50 and 100 milliseconds. There are several kinds of compression aids; it has not yet been determined which is best. The aid with compression characteristics is for the person who is very sensitive to loud sounds or who works in a noisy environment.

Directional hearing aids have the capability of amplifying sounds from the rear. For persons in some noisy environments this can be an advantage. There can be disadvantages also. In the street, warning signals from the rear might not be heard. In the home, conversations from behind the listener may be too low to be heard. The directional aid should be recommended only for the person whose auditory needs and sonic environment indicate it.

#### ELIGIBILITY FOR AN AID

The only persons who are not candidates for hearing aids are those who have normal hearing throughout the frequency range from 250 Hz. to 4,000 Hz. All others might profit from the use of a hearing aid suitable for their loss. The great majority of those who might benefit from amplification but do not yet wear aids are persons with high-frequency loss. In quiet surroundings the redundancies in speech make it easy for these persons to carry on conversations. In large rooms with more than one person communicating or in the presence of background noise, the elements of speech that provide intelligibility may be lost. The victim may then try to "suffer through," but his existence becomes frustrating and unhappy. Such individuals could become successful part-time users, wearing the aid when the occasion calls for it.

#### OPTIONS

The great variety of available aids provide many options for those whose hearing is impaired. As an example, consider the patient with mild loss in one ear with good discrimination and moderate loss in the other ear with a discrimination score of 72%. The first choice might be a CROS hearing

aid with the receiver in the better ear. However, an elderly patient might prefer a mild-gain hearing aid in the better ear because it would require minimum care and handling. In this actual case, the patient preferred to wear an aid in the ear with the greater loss even though his understanding in that ear was poor. He felt the loss of that ear keenly, and wanted his hearing "balanced" again. He performed very well with this aid, utilizing both ears once again.

Hearing aids can now be obtained in many different combinations: over-the-ear aids with directional and compression properties; eyeglass aids with a directional and nondirectional switch; or even aids which afford a choice of degrees of compression or directionality. The determination of which aid is best is based on the patient's audiometric configuration, age, occupation, his communication needs, and the sonic environment in which he lives. Sometimes the patient's preconceived ideas about hearing aids force the audiologist to make compromises. Even so, the choices are many.

#### COMMUNICATION THROUGH HEARING AIDS

However great the benefit that they offer, hearing aids should not be over-praised. They are simply amplifiers of limited fidelity. In a noisy environment they make communication very difficult. The hearing aid is a device designed to bring sound to the ear in such a manner as to compensate for a decrease in auditory acuity. The fact that a hearing aid is merely an amplifier must be underscored. In a quiet room most partly deafened persons may attain satisfactory benefit from their hearing aids. However, in a noisy environment—such as a busy street, cocktail party, or factory—a hearing aid may make the acoustic problem worse rather than better. The aid amplifies all sounds within its range—the unpleasant noise as well as the desired signal or speech. Patients usually are unprepared for this, and the experience colors their feelings about the aid. The key to successful use of the hearing aid, then, is not only the acquisition of suitable equipment but training and counseling in its use. These considerations should not be taken lightly. The public knows little about the impairment of hearing and the function of hearing aids. Hearing aids usually do not perform as well as the new user expects. Initial disappointment and failures of persistence often relegate the aid to the bureau drawer. Yet studies have shown that if the patient understands his impairment and the limitations of the apparatus and receives a few hours of instruction in

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auditory training and speech reading, he usually will become a steady wearer of the hearing aid. If he can be prevailed upon to wear his new hearing aid for two to four weeks, the chances of his achieving satisfactory adjustment to the aid are greatly increased.

#### THE FUTURE

Certain developments already can be seen on the horizon. Methods to eliminate feedback in hearing aids are being developed. Research now in progress will eventually permit the enhancement of the speech signal and the deletion of noise. Such positive actions will be advantageous to the wearer and undoubtedly will convince many who have rejected hearing aids to reconsider their use. I predict that future users of hearing aids will have an advantage over normal listeners in the presence of noise. Research presently underway in many laboratories will help us discard old ideas about design and use. The outlook is immensely favorable.